

### Remarks

Claim 37 is currently amended. Support for the amendment can be found at, for example, the Abstract of the originally filed application. The Applicants respectfully request entry of the amendment which is believed to place the application in better condition for allowance or, alternatively, appeal.

Claim 35 is rejected as obvious under 35 USC §103(a) over the combination of US '598 with US '619.

Claim 35 is not obvious over the combination of US '598 with US '619. The lubricant-feed-state monitoring sensor of Claim 35 comprises "a piezoelectric element that generates voltage by...bending deflection." As correctly recognized in the rejection, US '619 does not teach this element. Moreover, US '598 also fails to teach this element. This is because the detectors in US '593 are "piezo-resistive Wheatstone bridge[s]." *See e.g.* US '619 at paragraph [0052]. This means that the detectors disclosed in US '598 do not generate voltage.

In fact, as will be discussed in more detail below, the piezoresistive effect is entirely different than the piezoelectric effect and the structure of detectors utilizing either principle as well as the materials in these detectors are necessarily different as a result. This is readily apparent from a comparison of the structure of the piezoelectric detector shown in Fig. 2 of the current application and the structure of the piezoresistive detector shown in Fig. 12 of US '598.

The piezoelectric effect occurs when a material is deformed and generates an electrical potential or voltage. In a detector utilizing the piezoelectric effect a voltage is generated by pressure induced deformations of a piezoelectric material in the detector and this voltage is then measured. Thus, the piezoelectric effect results in the production of a voltage. No external voltage is provided. In fact, the application states at paragraph [0013] of the originally filed application "there is no need to have a driving power source[,] that "the piezoelectric element generates voltate[,]" and that the piezoelectric element "can output voltage larger than that of [the] detect[ed] pulsed voltage of the lubricant."

In sharp contrast, the piezoresistive effect occurs when a material is deformed and the resistance of the deformed material increases. In a detector utilizing the piezoresistive effect an increase in the electrical resistance of the piezoresistive material in the detector is generated by pressure induced deformations of this material and this increased resistance is then measured. Thus, the piezoresistive effect results in a increased resistance across a piezoresistive detector

and does not generate a voltage. Instead, a voltage must be provided so changes in the electrical resistance of the piezoresistive material can be measured. Furthermore, it is clear that a piezoelectric material and a piezoresistive material are not the same based on their different physical properties.

Altogether, this means the piezoresistive Wheatstone bridge based detector of US '598 is not "a piezoelectric element that generates voltage by...bending deflection." Instead, the piezoresistive Wheatstone bridge is an entirely different sensor element with a different construction that uses physically different materials and which measures the resistance to an externally generated voltage across the Wheatstone bridge. This is evident from Fig. 12 of US '598 which clearly shows the presence of piezoresistors in the Wheatstone bridge.

This means the rejection fails to establish *prima facie* obviousness because the combination of US '598 with US '619 fails to result in all the elements of Claim 35. The Applicants respectfully request the withdrawal of the rejection of Claim 35 as obvious over US '598 and US '619.

Claim 36 is rejected as obvious under 35 USC §103(a) over the combination of US '619, US '598 and US '129.

Claim 36 is not obvious over the combination of US '598 and US '129 with US '619. This is because US '129 does nothing to cure the deficiencies of the core combination of US '619 and US '598 which are discussed above. Furthermore, it is clear that US '129 does not teach a "flexible material that coats the piezoelectric element" as required by Claim 36. This is because, as the rejection correctly recognizes, the TEFLON™ heat shrink tubing taught in US '129 provides "mechanical protection and electrical insulation [(emphasis added).]" This means that in US '129 the TEFLON™ heat shrink tubing provides a rigid, chemically inert housing which is required to protect the inner works of the pipetter from damage and mechanical shocks (which could cause the device to eject or aspirate any liquid contents or to otherwise malfunction). In fact, the type of pipetter housing construction US '129 attempts to describe is also seen in conventional mechanical pipetters (e.g. EPPENDORF™ micropipetters) in which the pipetter housings are constructed, for the same reasons, of rigid, chemically inert materials such as TEFLON™ or other polymers. Thus, it is clear the housings constructed of TEFLON™ heat shrink tubing described in US '129 are not a "flexible material" that coats "a piezoelectric element that generates voltage by...bending deflection."

This means that the rejection fails to establish *prima facie* obviousness because the combination of US '598 and US '129 with US '619 fails to result in all the elements of Claim 36. The Applicants respectfully request the withdrawal of the rejection of Claim 36 as obvious over the combination of US '598 and US '129 with US '619.

Claims 37-40 are rejected as obvious under 35 USC §103(a) over the combination of US '656 with US '598.

Claims 37-40 are not obvious over the combination of US '656 with US '598. Claim 37 has been amended to recite the step of "converting strain generated by the sensor due to ... bending deflection to an electrical signal, wherein the sensor is a piezoelectric element that generates voltage by the bending deflection[.]" As discussed above, US '598 does not teach a sensor that is "a piezoelectric element that generates voltage by ... bending deflection[.]" The teachings of US '656 do nothing to correct this deficiency of US '598.

This means the rejection fails to establish *prima facie* obviousness because the combination of US '656 with US '598 fails to teach all the elements of amended Claims 37-40. The Applicants respectfully request the withdrawal of the rejections of Claim 37-40 over the combination of US '598 with US '656.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,



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